Title: **LIQUID CRYSTAL DISPLAY**

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Cross Reference to Related Applications

[0001] This application claims priority of Taiwan Patent Application Serial No. 092100646 filed on January 13, 2003.

Field of Invention

[0002] The present invention relates to a liquid crystal display (LCD) of reduced reflection phenomenon.

Background of the Invention

[0003] The reflection of ambient light from an LCD panel would reduce CONTRAST of the liquid crystal display. To increase the CONTRAST, a black matrix layer is disposed inside the liquid crystal display to block the ambient light. The black matrix layer may also cover the area where the liquid crystal is not ordered enough to elevate image quality.

[0004] Fig. 1 shows a cross-sectional diagram of a liquid crystal display according to the prior art. A polysilicon layer **128** and an insulator layer **106** are disposed on a first substrate **102**. A gate **126** is formed by an extension of a gate line (not shown). An interlayer dielectric layer **108** is formed on the gate **126** and the insulator layer **106**. Source/drains **122, 124** are selectively formed by an extension of a data line (not shown). The source/drains **122, 124** are disposed on the interlayer dielectric layer **108** and contact the polysilicon layer **128**. The source/drains **122, 124** and the gate **126** form a transistor.

A planarization layer **110** is formed on the interlayer dielectric layer **108** and the source/drains **122, 124**. A pixel electrode **112** is formed on the planarization layer **110**, and electrically connected to the source/drain **124**. Color filters **114** are disposed on a second substrate **104**. A black matrix layer **120** is located on the second substrate **104** and lies between the color filters **114**. A liquid crystal layer **118** is located between the pixel electrode **112** and color filters **114**.

[0005] The source/drains **122, 124** and the gate **126** are typically formed by metal, which generally has high reflectivity. The first substrate **102** has to be aligned with the second substrate **104** to ensure that the source/drains **122, 124** and the gate **126** are covered by the black matrix layer **120**, so that reflection phenomenon is reduced. To cover the source/drains **122, 124** and the gate **126** effectively, typically, the area of the black matrix layer **120** is large. However, larger black matrix area would result in smaller aperture ratio.

Summary of the Invention

[0006] One aspect of the present invention provides a liquid crystal display having anti-reflection layer for reducing reflection phenomenon of the liquid crystal display.

[0007] A liquid crystal display of reduced reflection phenomenon, including a first substrate and a second substrate, is provided. A switch is disposed on the first substrate to control brightness of the liquid crystal display. A data line has an extension to selectively form source/drains of the switch. A first electrode is electrically connected to the data line. An anti-reflection layer of an anti-reflection material is disposed on the data line to reduce reflection phenomenon of the liquid crystal display. A second electrode is disposed on the second substrate. And a liquid crystal layer is disposed between the second electrode and the switch.

[0008] A liquid crystal display of reduced reflection phenomenon, including a first substrate and a second substrate, is provided. A switch is disposed on the first substrate to control brightness of the liquid crystal display. A gate line has an extension to form a gate of the switch. A first electrode is electrically connected to the data line. An anti-reflection layer of an anti-reflection material is disposed on the gate line to reduce reflection phenomenon of the liquid crystal display. A second electrode is disposed on the second substrate. And a liquid crystal layer is disposed between the second electrode and the switch.

Brief Description of the Drawings

[0009] For a more complete understanding of the present invention, and the advantage thereof, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, in which:

[0010] Fig. 1 is a cross-sectional diagram of a liquid crystal display according to the prior art, which has a black matrix layer and a data line;

[0011] Fig. 2 is a schematic diagram showing a relative position of a data line and a gate line of an exemplary embodiment;

[0012] Fig. 3 is a cross-sectional diagram of a first exemplary embodiment, in which a data line has an anti-reflection layer and a color filter is disposed on a second substrate;

[0013] Fig. 4 is a cross-sectional diagram of a second exemplary embodiment, in which a data line has an anti-reflection layer and a color filter is disposed on a first substrate;

[0014] Fig. 5 is a cross-sectional diagram of a third exemplary embodiment, in which a data line has an anti-reflection layer and a color filter is disposed on a first substrate;

[0015] Fig. 6 is a cross-sectional diagram of a fourth exemplary embodiment, in which a gate line has an anti-reflection layer; and

[0016] Fig. 7 is a cross-sectional diagram of a fifth exemplary embodiment, in which both a data line and a gate line have an anti-reflection layer.

Detailed Description

[0017] A liquid crystal display having an anti-reflection layer is provided. The anti-reflection layer is disposed on a data line or a gate line to reduce reflection phenomenon and elevate CONTRAST.

[0018] Fig. 2 is a schematic diagram showing a relative position of a data line and a gate line of an exemplary embodiment. The data line **202** and the gate line **204** are staggered to each other. The data line **202** has an extension to selectively form source/drains **206, 208**. The gate line **204** has an extension to form a gate **210**. A pixel electrode **212** is electrically connected to the source/drain **208**. The anti-reflection layer of the present invention may be formed on one of or both the data line **206** and the gate line **208**.

[0019] Fig. 3 is a cross-sectional diagram of a first exemplary embodiment. The first substrate **302** and the second substrate **304** may be glass substrates or similar. A semiconductor layer **328**, preferably being a polysilicon layer or an amorphous silicon layer, is disposed on the first substrate **302**. An insulator layer **306** is located on the semiconductor layer **328**. A gate **326** formed by an extension of a gate line is disposed on the insulator layer **306**. An interlayer dielectric layer **308** is formed on the gate **326** and the first substrate **302**. Source/drains **322, 324**selectively formed by an extension of the data line, are disposed on the interlayer dielectric layer **308** and contact the semiconductor layer **328**. The gate **326**, the source/drains **322** , **324** form a switch, e.g. thin film transistor. A planarization layer **310** is formed on the interlayer dielectric layer **308** and the source/drains **322, 324**. A first electrode **312**, namely pixel electrode, is formed on the planarization layer **310** and electrically connected to the source/drain **324**. The first

electrode **312** is preferably composed of Indium Tin Oxide (ITO), Indium Zinc Oxide (IZO), or similar.

[0020] With continued reference to Fig. 3, an anti-reflection layer **320** is disposed on the source/drain **322**. The anti-reflection layer **320** has the same pattern as the data line and the source/drain **322**. Therefore, no additional optical mask is needed to fabricate the anti-reflection layer **320**. The anti-reflection layer **320** is composed of anti-reflection material, which may reduce reflection inside the liquid crystal display. The anti-reflection material may preferably be chromium oxide, silicon nitride, or other appropriate reflection-reducing material. Color filters **314** may be formed on the second substrate **304** to form color display. A second electrode **316** is formed on the color filters **314**. The second electrode **316**, also known as common electrode, is preferably composed of ITO or similar. A liquid crystal layer **318** is located between the second electrode **316** and the planarization layer **310**. In the first exemplary embodiment, the anti-reflection layer **320** is formed directly on the source/drain **322**. Therefore, no excess area of the anti-reflection layer **320** is needed to cover the source/drain **322**, and the aperture ratio may be effectively raised.

[0021] Fig. 4 is a cross-sectional diagram of a second exemplary embodiment. The main difference between the first and second exemplary embodiments is that the color filter **414** is formed directly on the first electrode **312**. As shown in Fig. 4, the first electrode **312** is located between the color filter **414** and the planarization layer **310**. And the second electrode **416** is formed directly on the second substrate **304**. In the second exemplary embodiment, the color filter **414** is formed directly on the first electrode **312**. Therefore, it would not be necessary to align the color filter **414** with the first substrate **302**, which is required for the first exemplary embodiment.

[0022] Fig. 5 is a cross-sectional diagram of a third exemplary embodiment. The main differences between the second and third exemplary embodiments are that the color filter **414** is formed directly on the planarization layer **310** and the first electrode **412** is formed on the color filter **414**.

[0023] Fig. 6 is a cross-sectional diagram of a fourth exemplary embodiment. The main difference between the first and fourth exemplary embodiments is that the anti-reflection layer **420** is formed on the gate **326**. The anti-reflection layer **420** is composed of anti-reflection material, which may reduce reflection inside the liquid crystal display. The anti-reflection material may preferably be chromium oxide, silicon nitride, or other appropriate reflection-reducing material. The anti-reflection layer **420** has the same pattern as the gate line and the gate **326**. Therefore, no additional optical mask is needed to fabricate the anti-reflection layer **420**. For the fourth exemplary embodiment, the color filter **314** may also locate directly on the first electrode **312** or the planarization layer **310**, as shown in Fig. 4 and Fig. 5.

[0024] Fig. 7 is a cross-sectional diagram of a fifth exemplary embodiment. Being different from the first and fourth exemplary embodiments, both anti-reflection layers **320** and **420** are formed. Then the reflection inside the liquid crystal display is effectively reduced and the CONTRAST is elevated. For the fifth exemplary embodiment, the color filter **314** may also locate directly on the first electrode **312** or the planarization layer **310**, as shown in Fig. 4 and Fig. 5.

[0025] Though the embodiments described herein adopt the top-gate structure, other structures, such as the bottom-gate structure, may still be suitable for this invention.

[0026] While this invention has been described with reference to the illustrative embodiments, these descriptions should not be construed in a limiting sense. Various modifications of the illustrative embodiment, as well as other embodiments of the

invention, will be apparent upon reference to these descriptions. It is therefore contemplated that the appended claims will cover any such modifications or embodiments as falling within the true scope of the invention and its legal equivalents.